1
INTRODUCTION

This report, sponsored by the Federal Emergency Management Agency (FEMA), reviews the literature and existing procedures on rapid visual screening in order to determine a recommended procedure as a first step toward the development of a handbook on the rapid visual screening of buildings for potential seismic hazards. The intent of the Handbook, which will be referred to as the *ATC-21 Handbook* (ATC, 1988), is to provide the target audience with a standard rapid visual screening procedure to identify those buildings that might pose potentially serious risk of loss and life and injury, or of severe curtailment of community services, in case of a damaging earthquake.

A rapid visual screening procedure (Rapid Screening Procedure, abbreviated RSP) is a methodology that, with associated background information, would permit an individual to visually inspect a building and, by obtaining selected data, to arrive at a decision as to which buildings should be further studied by an experienced professional engineer who would conduct a more in-depth review of the seismic capacity using structural drawings, design calculations, and perhaps inspecting the structure itself. The RSP inspection and decision-making process typically would occur on the spot, with perhaps two to four "average" buildings being reviewed per person-hour (i.e., 15 to 30 person-minutes per building). The personnel doing the rapid screening would typically not be experts in earthquake performance of buildings, but rather building inspectors, technicians or junior engineers.

Visual inspection would be a "sidewalk survey" done from the street, without benefit of entry to the building and without access to the structural drawings or most other supplementary information. In some cases, general structural general structural system-related information may be available to the inspector via building department or tax assessor files. (Note, however, that experience has shown the latter often to be unreliable with regard to structure information.) In effect, the inspector would note the dimensions of the building, its occupancy, structural materials and systems, condition, and other information. This information would be entered onto a form (on a clipboard or electronically), and employed in algorithms to determine a seismic hazard ranking for that building.

The RSP would be the first step of a two or more step process, in which ideally the RSP would permit (i) identification of those buildings that require additional, more detailed investigation by qualified engineers, and (ii) prioritization of the buildings to be further investigated, so that technical and other resources could be most effectively utilized.

It should be emphasized that any RSP is by definition a very approximate procedure, which will almost certainly fail to identify some potentially seismically hazardous buildings. The goal is to broadly identify *most* of the potentially seismically hazardous buildings, at a relatively modest expenditure of time and effort, and to eliminate *most* of the relatively adequate buildings from further review. Lastly, an RSP is a methodology intended for rapidly evaluating the hundreds or thousands of buildings in a community. It is *definitely not* intended for the full determination of the seismic safety of individual buildings.

The target audience for the *ATC-21 Handbook* includes:

- local building officials
- professional engineers

- registered architects
- building owners
- emergency managers
- interested citizens

Any or all of these people might be involved in efforts to identify a community's seismically hazardous buildings and mitigate the hazard. It is recognized, however, that building inspectors are the most likely group to implement an RSP, and this group is considered the primary target audience.

This report identifies, reviews, and critiques those RSP's currently or previously used to evaluate seismically hazardous buildings. For each method the following is provided:

- a description and discussion of technical advantages and disadvantages, including suitability of scope and format, and costs of implementation
- impacts and implications of regional variations in construction practices and seismic loading levels
- suitability for use by each segment of the target audience
- the general level of uncertainty inherent in its use

Three main sources for identifying existing procedures were used:

- the technical literature
- discussions with jurisdictions and communities that have performed or attempted a survey of their seismically hazardous buildings
- practicing professional engineers who are called upon to provide opinions as to the seismic hazard of a building or other structures. (Prominent engineering firms have performed rapid screenings of hundreds of buildings.)

Technical literature was identified by electronic data retrieval (i.e., the Engineering Index, accessed via Dialog); citations furnished by the ATC-21 Project Engineering Panel; review of the National Information Service for Earthquake Engineering (NISEE) holdings at the Earthquake Engineering Research Center in Richmond, California; and information and references in the author's files.

There exists an extensive body of literature on methods of seismic analysis and/or review of existing buildings. However, most of these methods are simplified or more or less detailed engineering analysis procedures, involving computations of seismic demand and capacity, often with the benefit of the structural plans or similar detailed privy information. Although some of these methods contain an initial rapid visual screening element, most do not. Therefore, only those methods that explicitly have a rapid visual screening element have been reviewed herein, and no attempt has been made to review the much larger literature of seismic evaluation of existing buildings.

Following this first section, the remainder of this report consists of the following chapters:

Chapter 2: Definition of an ideal rapid visual screening procedure, against which existing methods are judged

Chapter 3: Summary of each of the RSP's identified

Chapter 4: Presentation of the evaluation criteria used in this project and a detailed evaluation of the following aspects of the RSPs reviewed herein:

- Organizational
- Structural
- Configuration
- Site and Non-structural
- Personnel

Chapter 5: Recommended procedure for rapid visual screening of buildings for potential seismic hazards

Lastly, the appendices include typical data sheets employed in several of the surveys reviewed; an explanation of the determination of the Basic Structural Hazard scores and modifiers; the criteria for selection of a cut-off Structural Score; and a list of the ATC-21 project participants.